Evaluation of the energy recovery potential of thermoelectric generators in diesel engines

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Abstract

Thermoelectric generation is an alternative to recover some of the wasted energy trough an exhaust of the internal combustion engines. This paper assesses the performance of a thermoelectric generator with 20 modules by implementing a waffle heat exchanger. Experimental results showed a variable range of power recovery from 57.87 W to 71.13 W for B10, B5, and Diesel. The highest energy conversion efficiency of the aforementioned thermoelectric device was of 3% with the highest load and the fastest rotational speed. Also, the recovery process reduced gaseous emissions such as CO, CO_2, NO, NO_x, and HC. Additionally, the smoke opacity per kWh is reduced at significant levels of operations such as 2.42% when using diesel, 2.65% when using B5 and 3% when using B10. However, when using biodiesel blends, NOx emissions were increased. Overall the biodiesel resulted in a higher power recovery performance versus the diesel.

Keywords

Energy recovery, Heat exchanger, Thermoelectric generator, Thermoelectric module, Internal combustion engine.